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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/530,588	05/05/2000	KIMIHIRO MATSUSE	2312-0866-2P	6686

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EXAMINER
QUACH, TUAN N

ART UNIT	PAPER NUMBER
2814	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/530,588	Applicant(s) MATSUSE ET AL.	
	Examiner Tuan Quach	Art Unit 2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 March 2002* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *63-88* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *63-88* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

This application presents a claim for subject matter not originally claimed or embraced in the statement of the invention. The said subject matter corresponds to the various limitations regarding the processing conditions now presented in claims 63-88. A supplemental oath or declaration is required under 37 CFR 1.67. The new oath or declaration must properly identify the application of which it is to form a part, preferably by application number and filing date in the body of the oath or declaration. See MPEP §§ 602.01 and 602.02.

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed. The method of formation should be reflected.

The abstract of the disclosure is objected to because it does not describe the invention as now presented in claims 63-88 regarding the processing conditions. Correction is required. See MPEP § 608.01(b).

Claims 84 and 87 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 84, WSi lacks antecedent basis; in claim 87 "gasses for forming a W film" lacks antecedent basis; forming a W film lacks antecedent basis, nitriding the W film lacks antecedent from base claims which only forms the barrier of WN or WSiN without any processing for forming a W film or a WSi film.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> **(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.**

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 79-88 are rejected under 35 U.S.C. 103(a) as being unpatentable over over Kasai et al. or Agnello et al. taken with Park et al. and Fleming et al.

Kasai et al. teach forming gate structure comprising polysilicon on gate oxide, forming barrier layer e.g., WN, forming tungsten thereon. See page 497, Fig. 2, page 499.

Agnello et al. teach forming multilayer structure comprising polysilicon layer, barrier refractory metal-silicon-nitrogen intervening layer, upper conductor layer thereon including refractory metal such as W. The use of TaSiN and the replacement of W for Ta is also taught. See column 5 lines 10-17, line 56 to column 6 line 28.

The references do not recite the CVD process to form the tungsten nitride or tungsten silicon nitride and the processing conditions.

Park et al. teach the use of CVD to form barrier such as WN. Conventional tungsten and nitrogen sources and parameters are also shown. See column 2 line 45 to column 3 line 12.

Fleming et al. teach the use of CVD to from tungsten nitride compounds for diffusion barrier. See the abstract, column 4 lines 21 to column 5 line 61. The use of conventional tungsten precursor and silicon precursor for forming WsiN barrier is also shown, column 6 line 6-39; the selection of appropriate composition for desired barrier characteristics would have been a matter of routine experimentation and optimization and as showin in Fleming et al. Figs. 1, 4, 5, and 9 and Agnello et al., column 3 line 47 to column 4 line 1 evidencing the routine experimentation and optimization for forming varying composition to optimize resistance, diffusion barrier characteristics and stability.

It would have been obvious to one skilled in the art in practicing the above process to have employed the CVD to form the barrier in question since such is conventional and advantageous to form desired barrier material having improved step coverage as evidenced by Park et al. and Fleming et al. It would have been obvious and would have been within the purview of one skilled in the art to have selected the desired processing parameters since such optimization is normally within the purview of one skilled in the art and would have a matter of routine experimentation and would have been conventional and obvious as evidenced by the parameters shown. The use of conventional alternative conductive materials, tungsten or silicon or nitrogen

precursors or conventional gate insulating materials not enumerated is well within the purview of one skilled in the art to have substituted conventional and suitable alternative materials and as acknowledged in the instant specification, e.g., page 12 lines 10-12, page 13 lines 14-15, page 15 lines 7-8, page 18 lines 16-21. Alternatively, official notice is taken regarding the substutition of such conventional and suitable alternative materials and precursors.

Claims 63-78 and 85-88 are rejected under 35 U.S.C. 103(a) as being unpatentable Agnello et al. or Kasai et al. taken with Park et al. and Fleming et al. and further in view of Sasaki et al. and Chang et al.

Agnello et al., Kasai et al., Park et al., and Fleming et al. are applied as above. Park et al. further shows the application of the barrier 42 followed by a desired conductor 44 in a contact hole to form wiring is also shown in Park et al., Figs. 4 and 5, column 3 line 14-40.

Sasaki et al. teach forming contact through insulating layer using barrier material comprising WsiN 39 followed by conductor such as W or Cu 40. The planarization to form plug is also shown. See the abstract and figures.

Chiang et al. teach multilevel interconnection including barrier in openings followed by conductor and then planarized, e.g., by CMP. Suitable barrier materials include various nitrides and metal silicon nitride, e.g., WN, tantalum silicon nitride, and conductor including Cu, W, etc. See column 13 line 35 et seq; column 18 line 64 to column 19 line 18.

It would have been obvious to one skilled in the art to have employed the above process in a contact hole in order to provide wiring having improved barrier characteristics as delineated in Park et al. The use of WSiN as barrier would have been conventional and obvious as evidenced by Fleming et al. as delineated above and as shown in Sasaki the abstract and figures wherein wiring layer having barrier such as WN or WSiN can be employed having improve barrier characteristics. The use of CMP for planarization is notoriously conventional to form plug and as such would have been obvious. It would have been obvious to one skilled in the art in practicing the Sasaki et al. or Park et al. to have employed on a conductor level or a metal layer in addition to a diffusion layer since such is conventional and advantageous as evidenced by Chiang et al. The selection of barrier having desired composition would have been obvious and would have been within the purview of one skilled in the art and as delineated in Fleming et al. and Agnello et al. as delineated above. The formation of predetermined portion in insulating film for a wiring portion and a connecting hole is well within the purview of one skilled in the art and as evidenced in Chiang et al., e.g., Figs. 7 and 10 and as such would have been obvious.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Quach whose telephone number is 703-308-1096. The examiner can normally be reached on M - F from 9 to 5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached on (703) 306-2794. The fax phone number for the organization where this application or proceeding is assigned is 703-308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Tuan Quach
Primary Examiner